

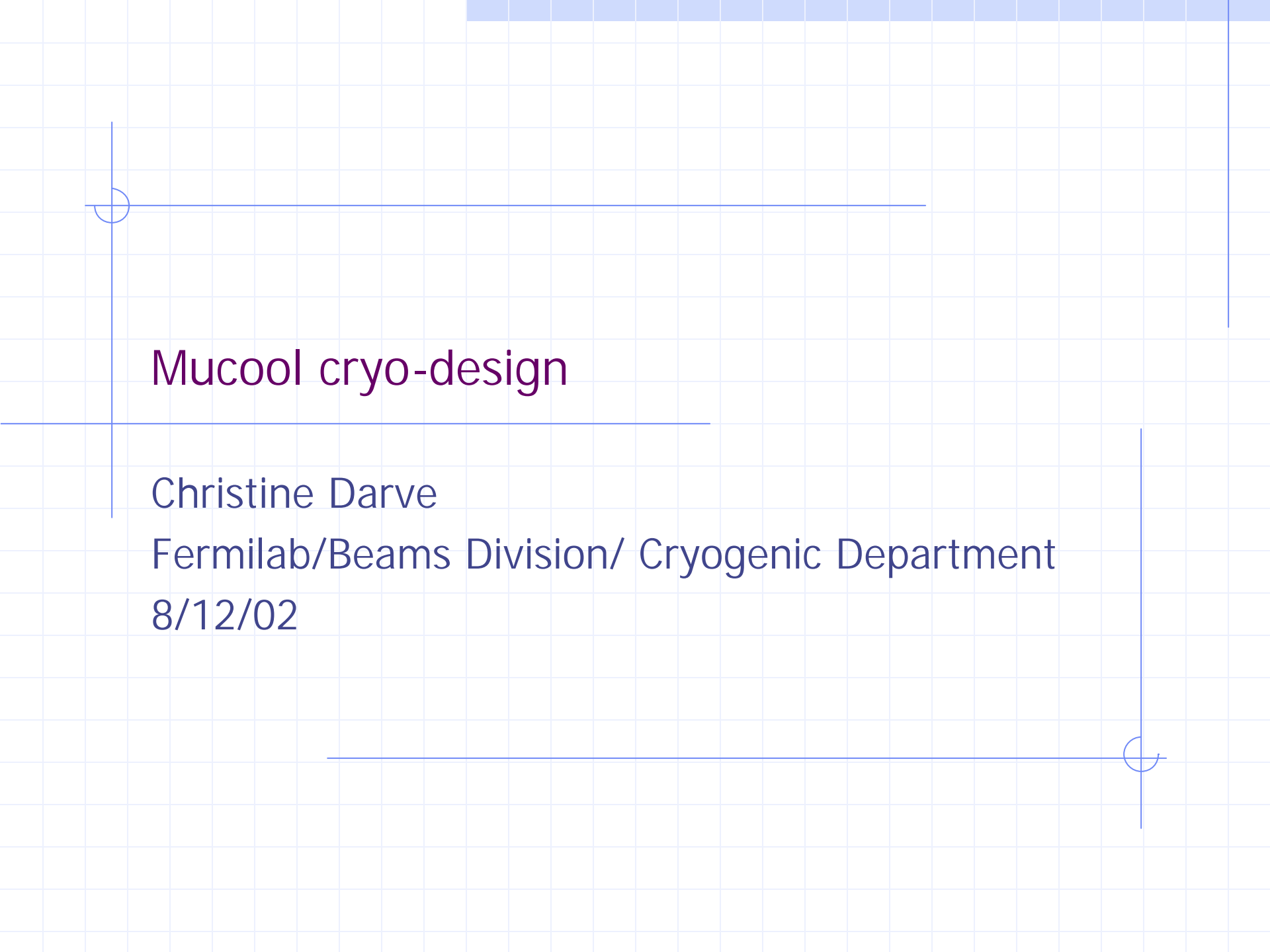


# Mucool cryo-design

Christine Darve

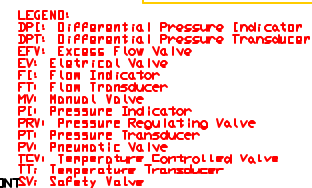
Fermilab/Beams Division/ Cryogenic Department

8/12/02

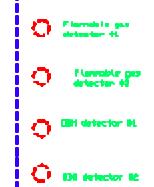


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# 10



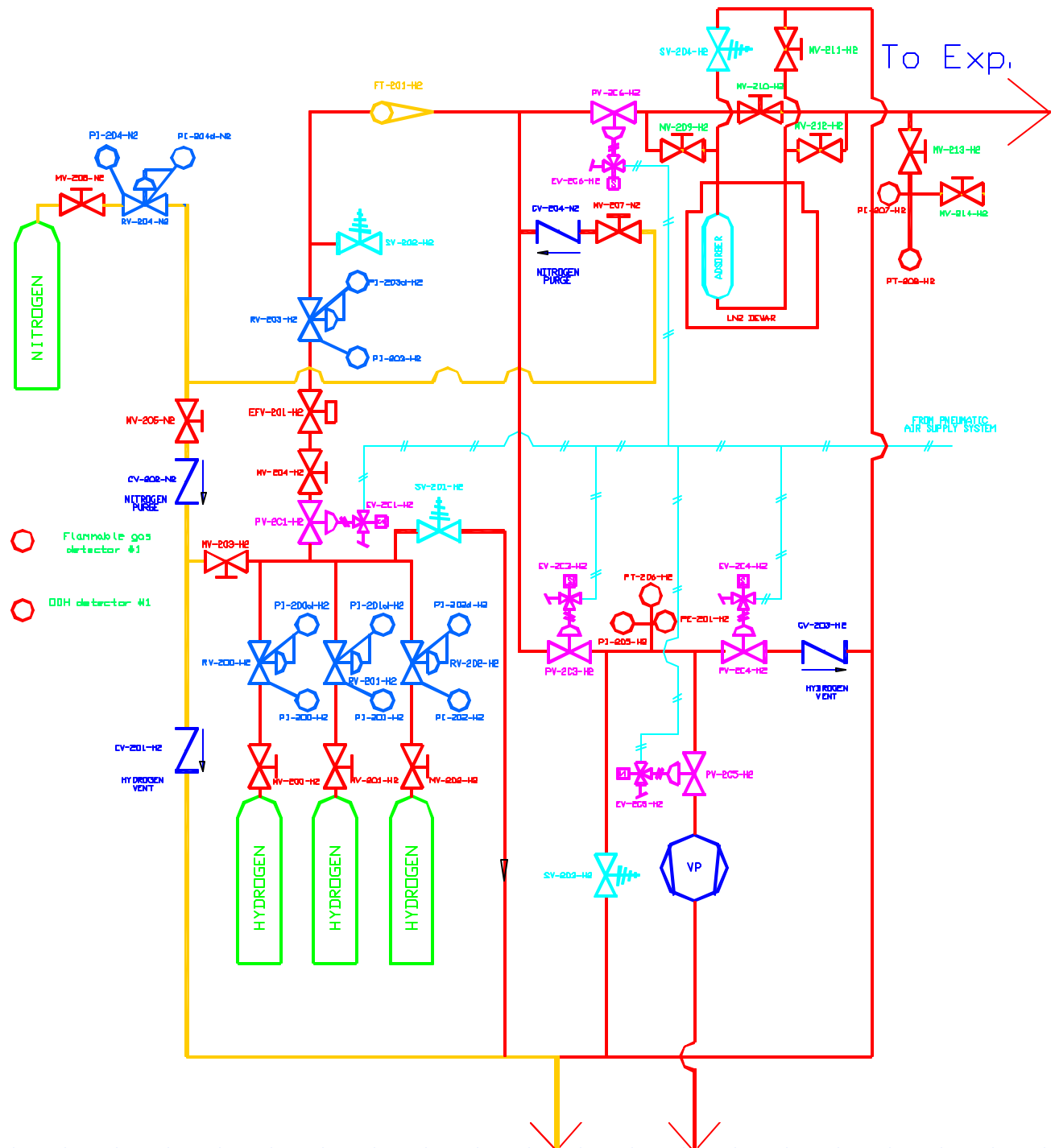
# Gas Shed

## Equipment:

- ◆ Gas H2 bottle
- ◆ Gas N2 bottle
- ◆ O2 adsorber
- ◆ Vacuum pump
- ◆ Flam. Gas detector
- ◆ ODH detector
- ◆ Pneumatic air supply system

## Instrumentation:

- ◆ Flowmeter Transducer
- ◆ Pressure Reg. Valve
- ◆ Safety Valve
- ◆ Manual Valve
- ◆ Excess flow Valve
- ◆ Pneumatic Valve
- ◆ Electrical Valve
- ◆ Check Valve
- ◆ Pressure Indicator
- ◆ Pressure Transducer



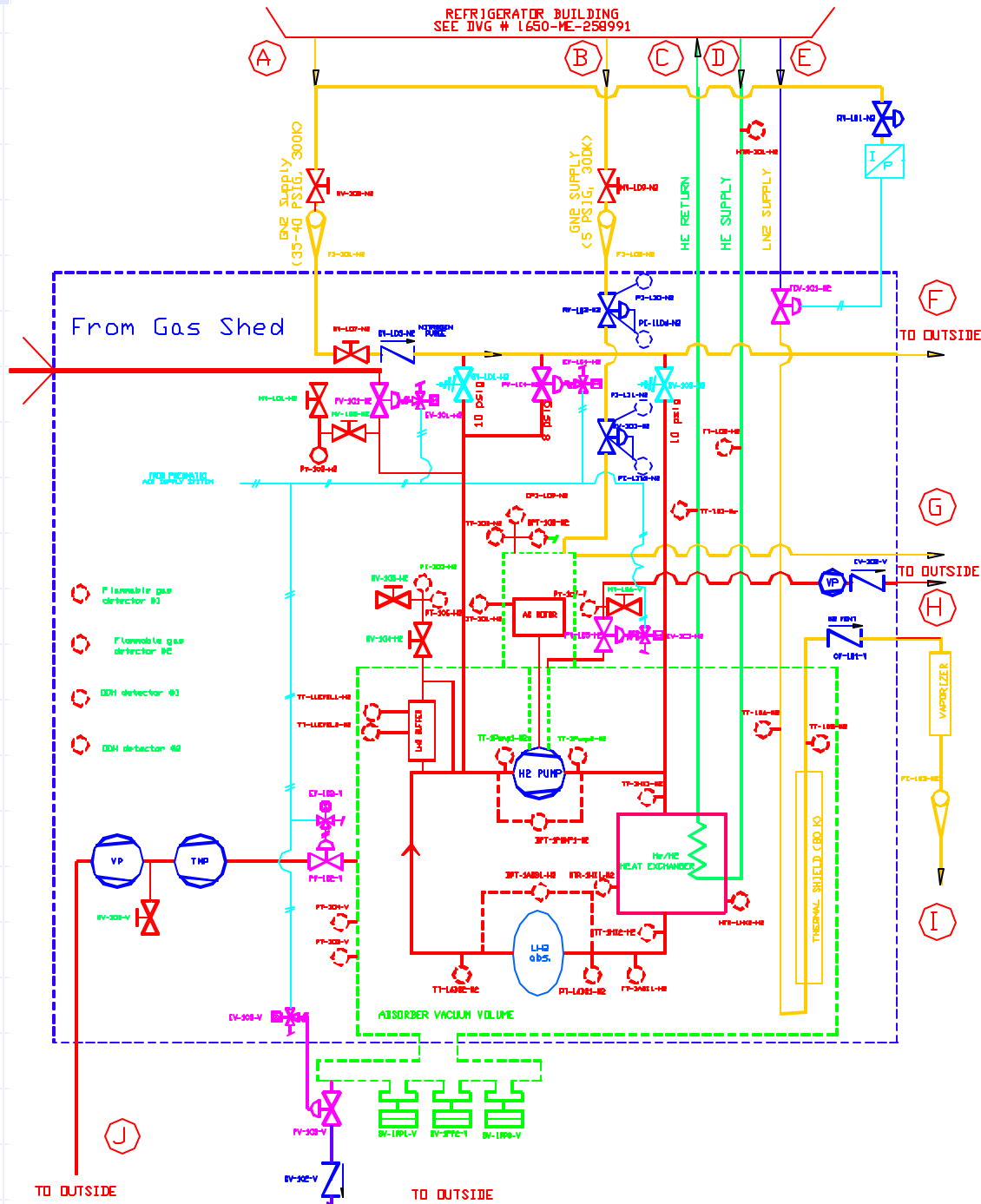
# Experimental Hall

## Equipment:

- ◆ Roughing Vacuum pump
- ◆ Turbo Molecular pump
- ◆ Gas He Supply/Return
- ◆ Gas N<sub>2</sub> Supply/Return
- ◆ Liq. N<sub>2</sub> Supply/Return
- ◆ Vaporizer
- ◆ Flam. Gas detector
- ◆ ODH detector
- ◆ Pneumatic air supply sys.

## Instrumentation:

- ◆ Temperature Transducer
- ◆ Pressure Transducer and Indicator
- ◆ Flowmeter Indicator
- ◆ Heater
- ◆ Safety Valve
- ◆ Temperature Controlled Valve
- ◆ Pressure Reg. Valve
- ◆ Manual Valve
- ◆ Pneumatic Valve
- ◆ Electrical Valve
- ◆ Check Valve



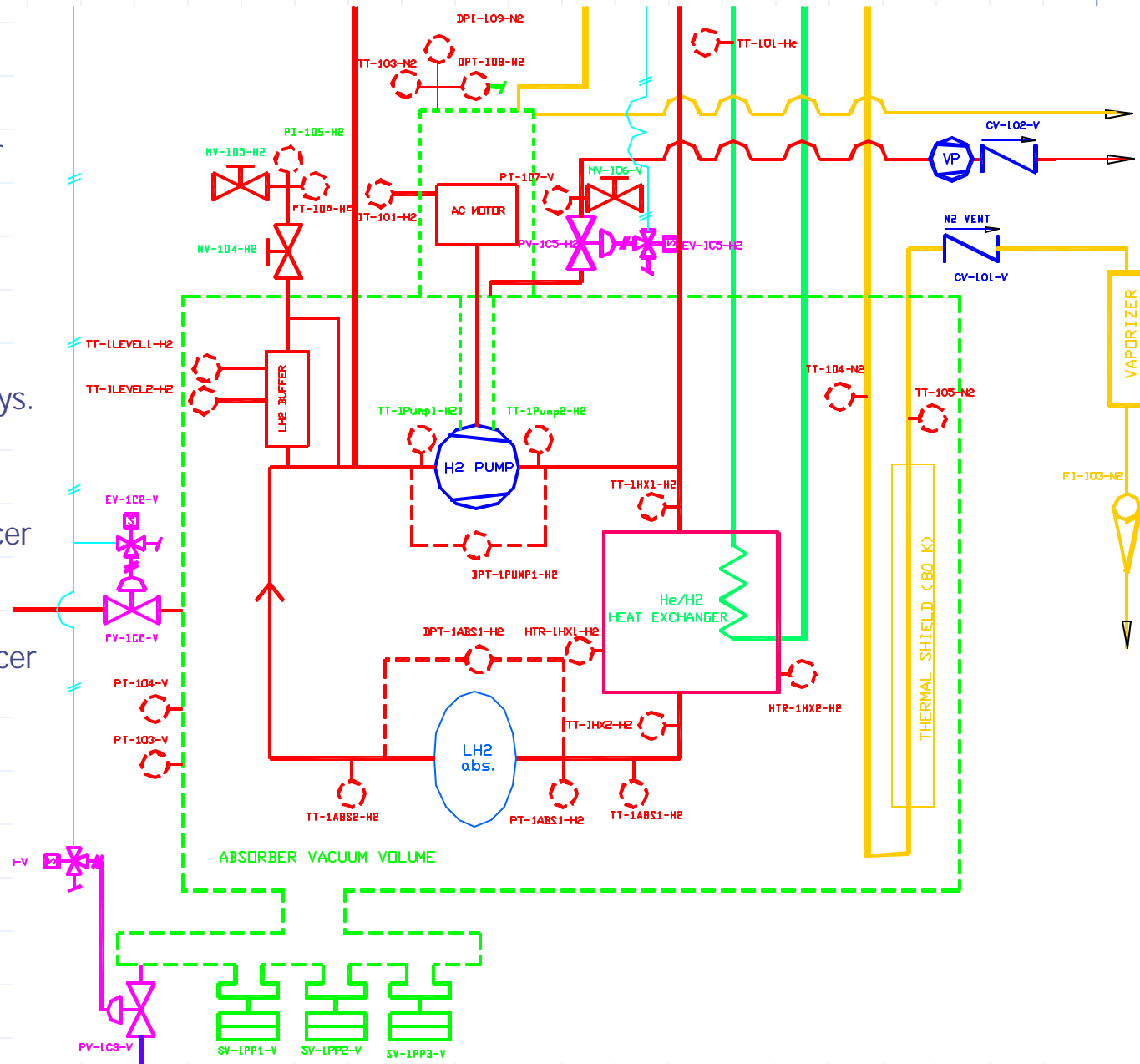
# Absorber Vacuum Vessel

## Equipment:

- ◆ Absorber
- ◆ He/H<sub>2</sub> Heat Exchanger
- ◆ LH<sub>2</sub> pump
- ◆ AC motor
- ◆ LH<sub>2</sub> buffer
- ◆ Vacuum pump
- ◆ Thermal shield
- ◆ Pneumatic air supply sys.

## Instrumentation:

- ◆ Temperature Transducer
- ◆ Pressure Transducer
- ◆ Pressure Indicator
- ◆ Diff. Pressure Transducer
- ◆ Heater
- ◆ Safety Valve
- ◆ Manual Valve
- ◆ Pneumatic Valve
- ◆ Electrical Valve
- ◆ Check Valve



# LH2 Absorber Cryostat design

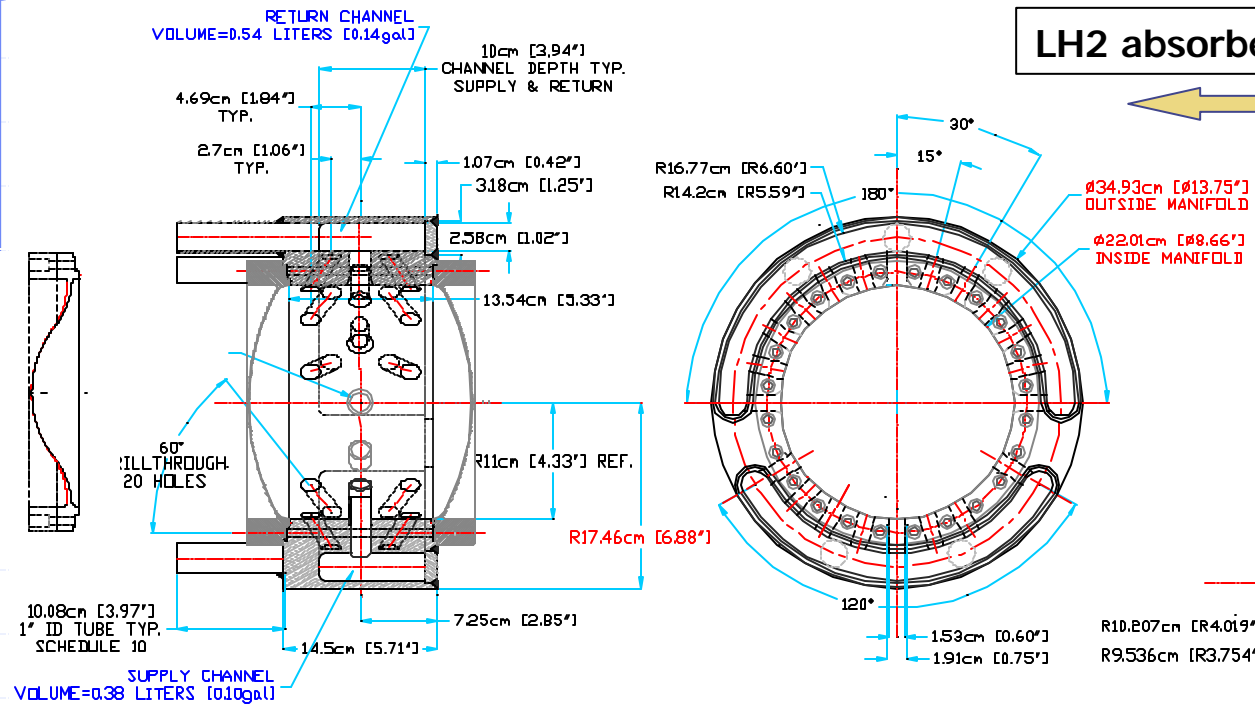
- ◆ The Cryostat is defined as the containment vessel.
- ◆ Vacuum volume around the absorber: safety+reduce the heat load to be extracted by the cryoloop.
- ◆ Maximum Allowable Working Pressure =25 psid

## Absorber cryostat design:

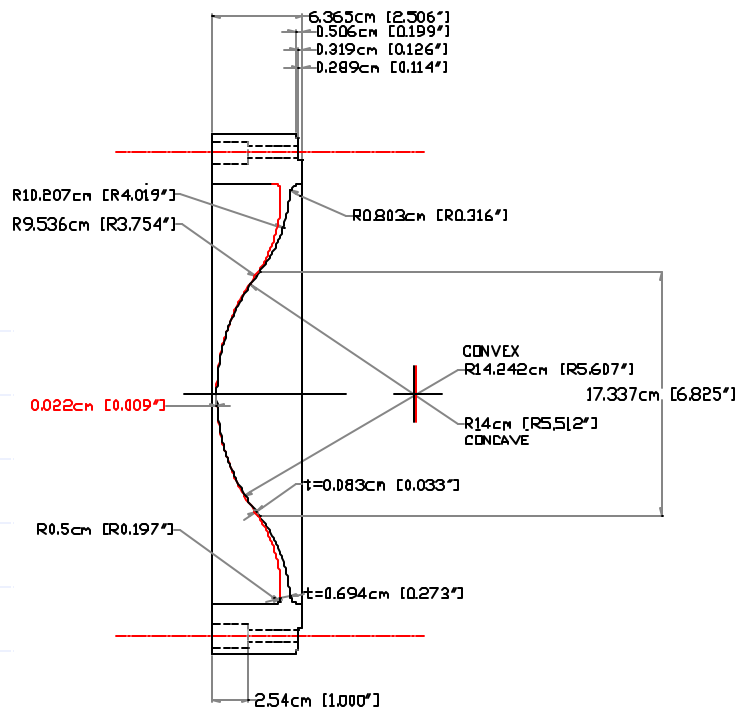
- LH2 absorber in the 5 T Lab-G magnet bore
- Safety devices for the LH2 cryo-loop
- Provide LH2 cooling within the admissible pressure drop limit imposed by the pump
- LH2 circulation provided by pump
- Heat exchange with the helium to ensure a temperature gradient in the LH2 less than 3 degrees
- Connect the helium refrigeration
- Insertion in the Linac Test Area



# LH2 Absorber Cryostat design

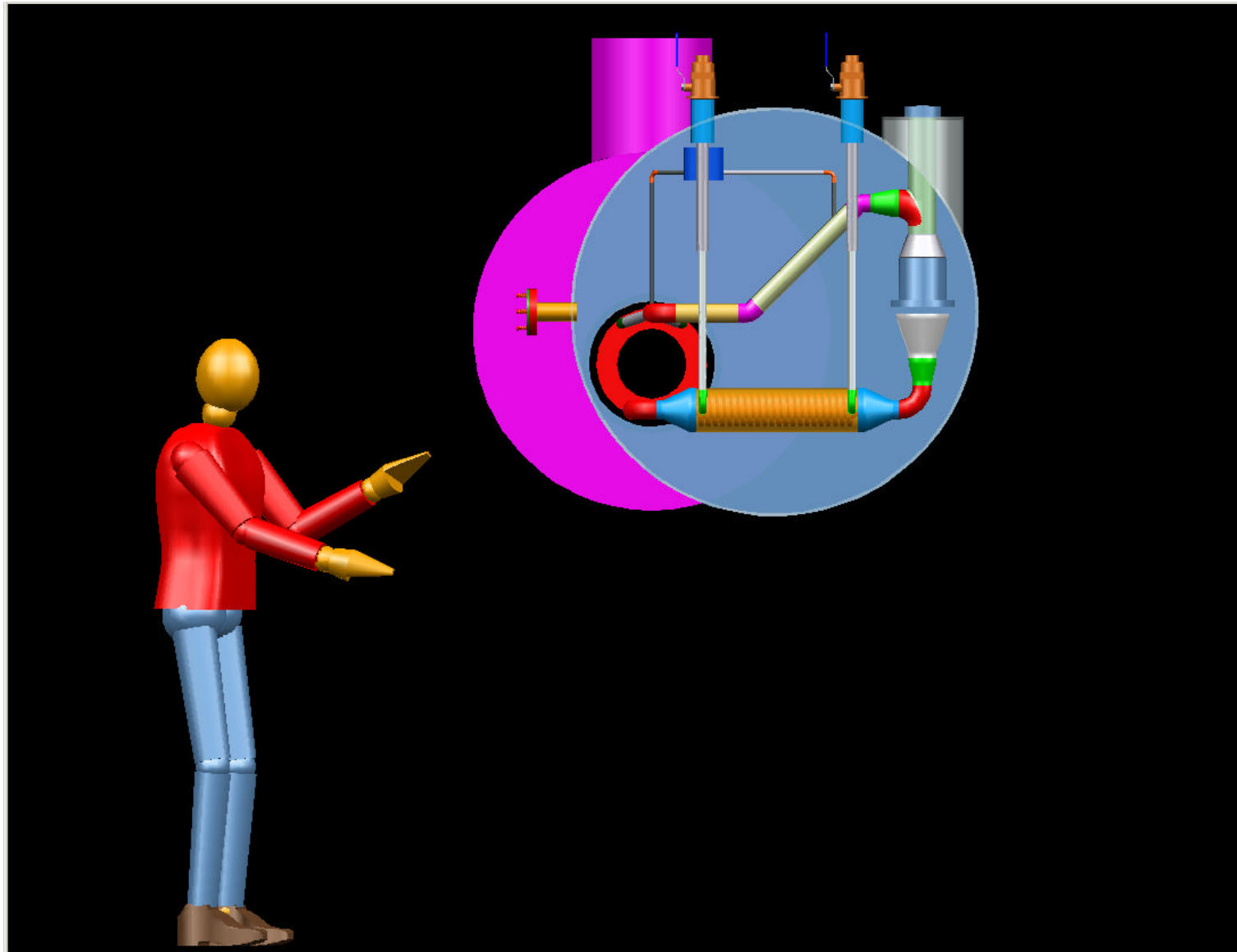


Shape of the 30 cm and 24 cm windows  
for the 2nd containment vessel

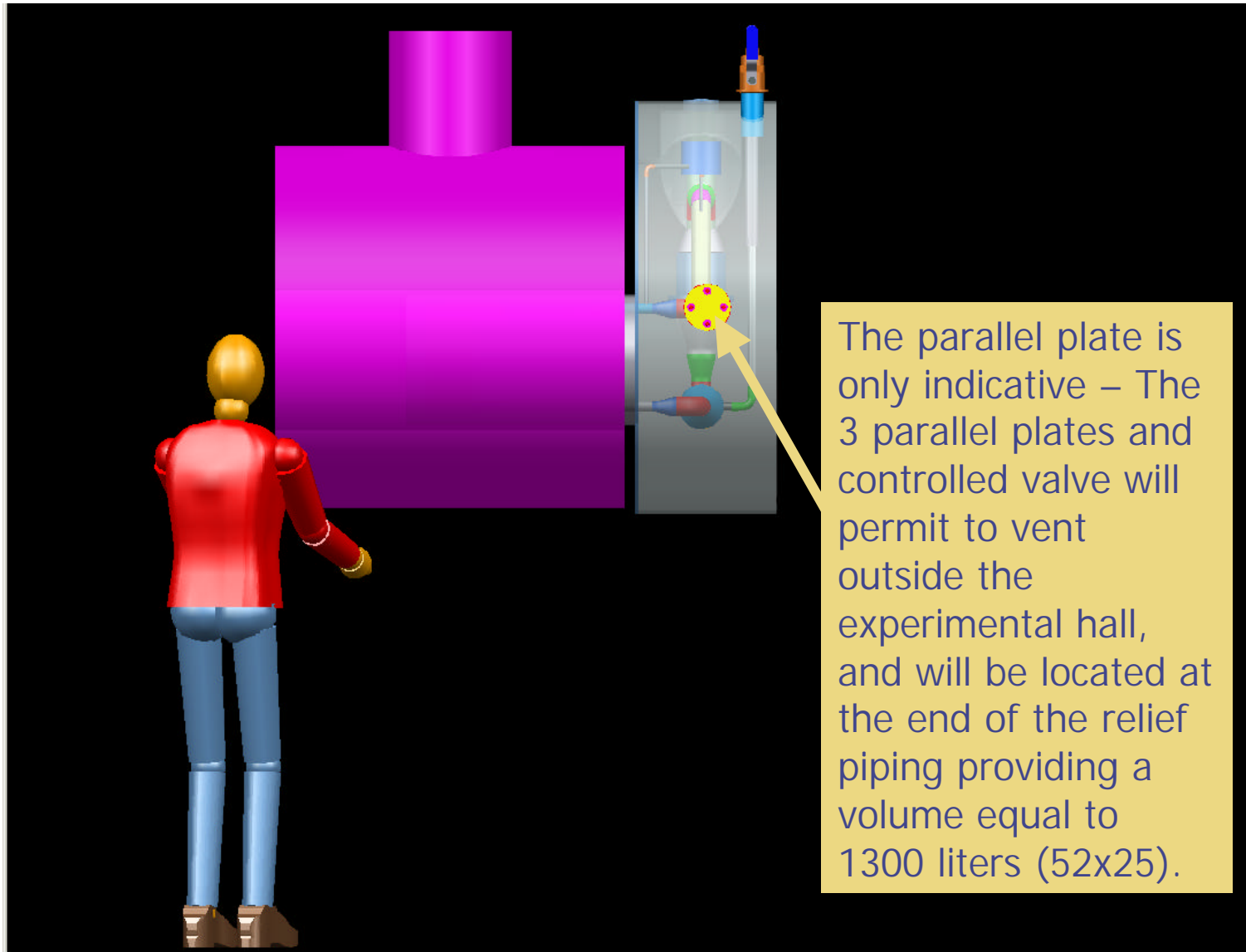




# LH2 Absorber Cryostat design

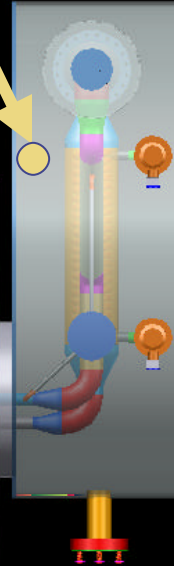
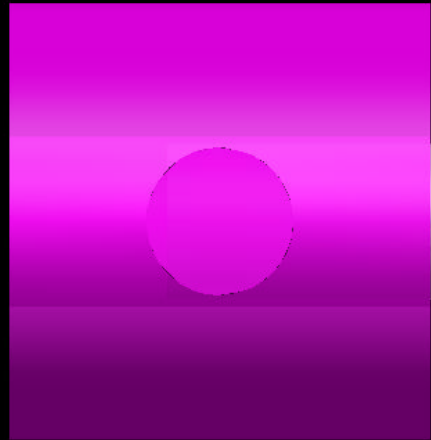


# LH2 Absorber Cryostat design



# LH2 Absorber Cryostat design

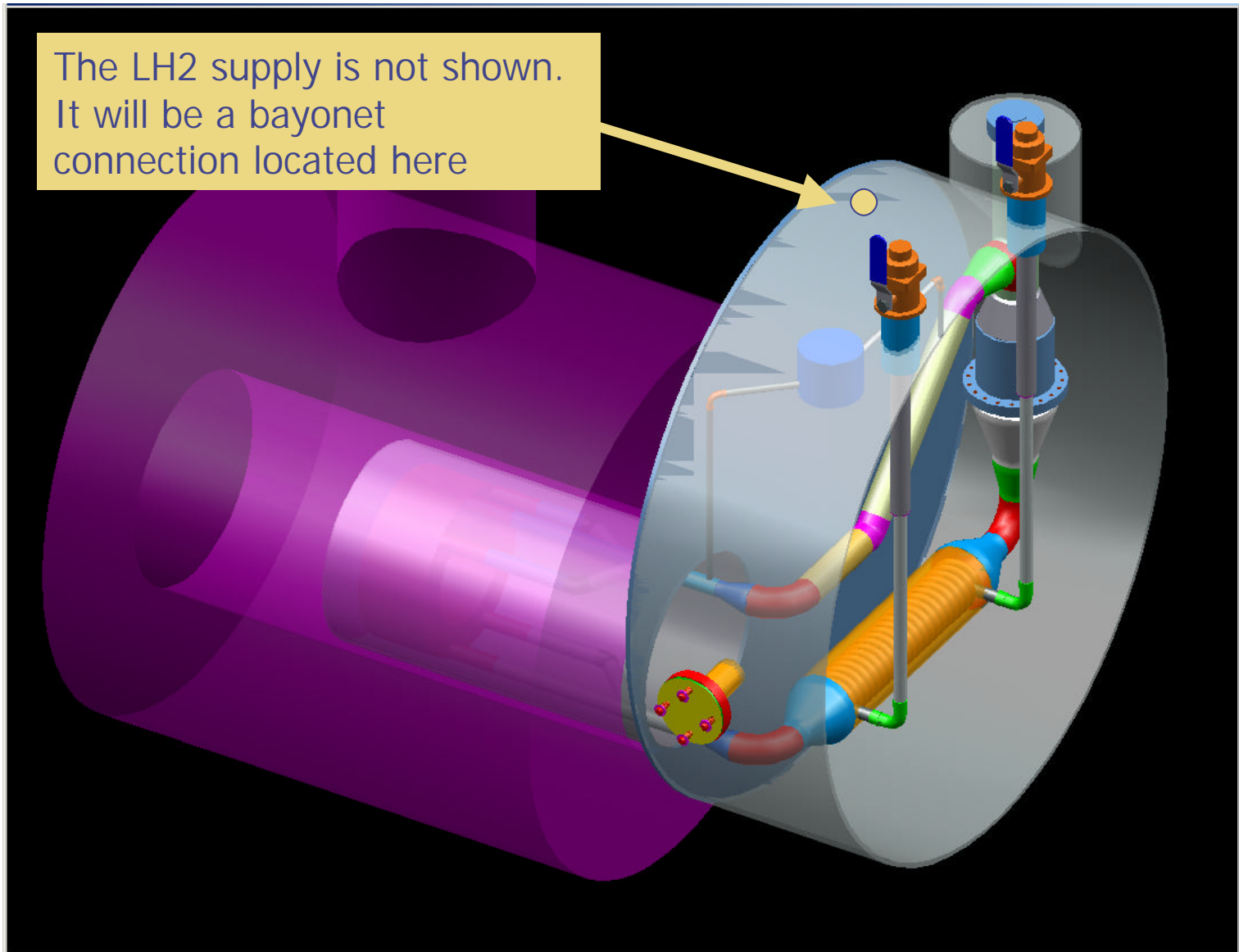
The LH2 supply is not shown.  
It will be a bayonet  
connection located here



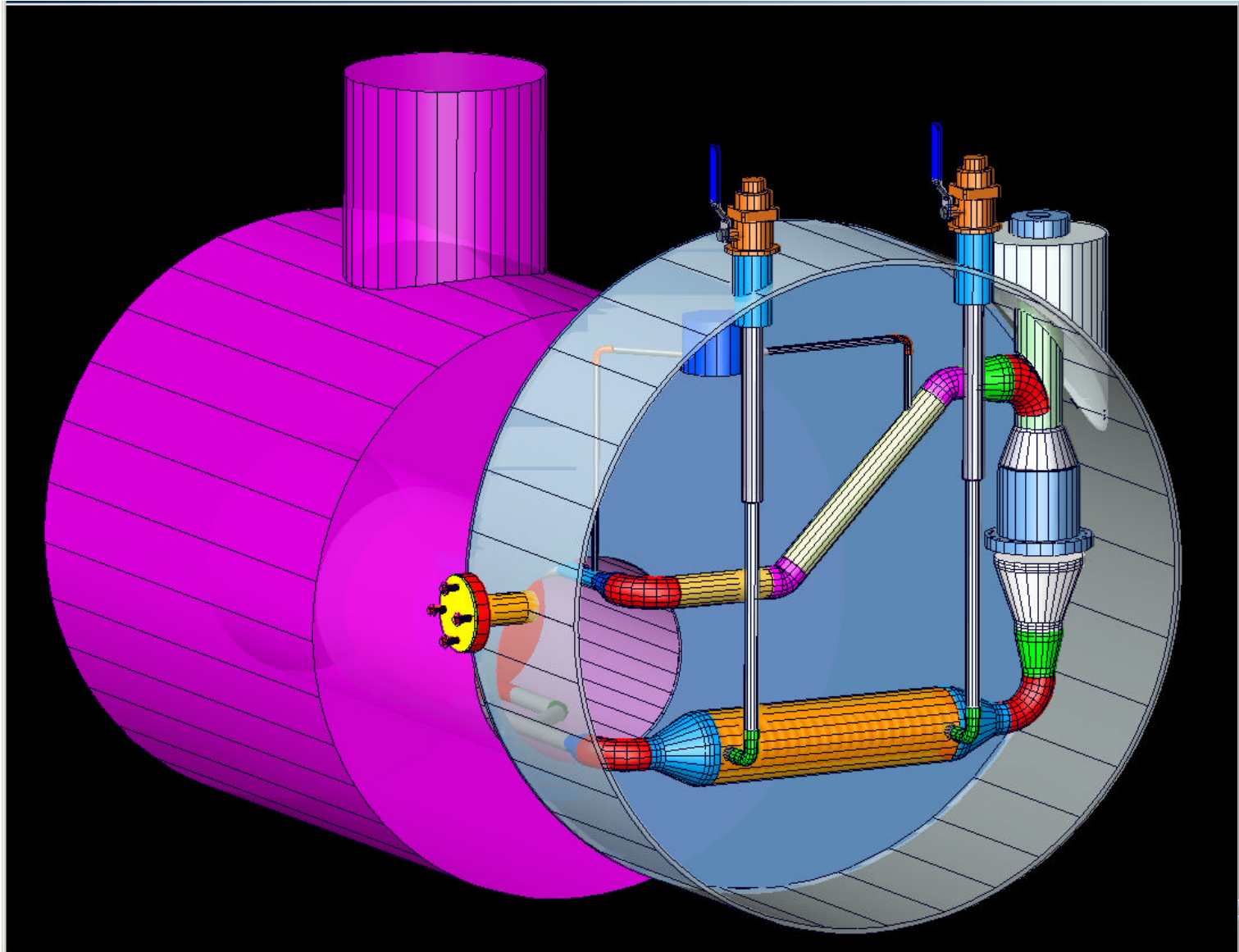
The parallel plate is  
only indicative – The  
3 parallel plates and  
controlled valve will  
permit to vent  
outside the  
experimental hall,  
and will be located at  
the end of the relief  
piping providing a  
volume equal to  
1300 liters (52x25).

# LH2 Absorber Cryostat design

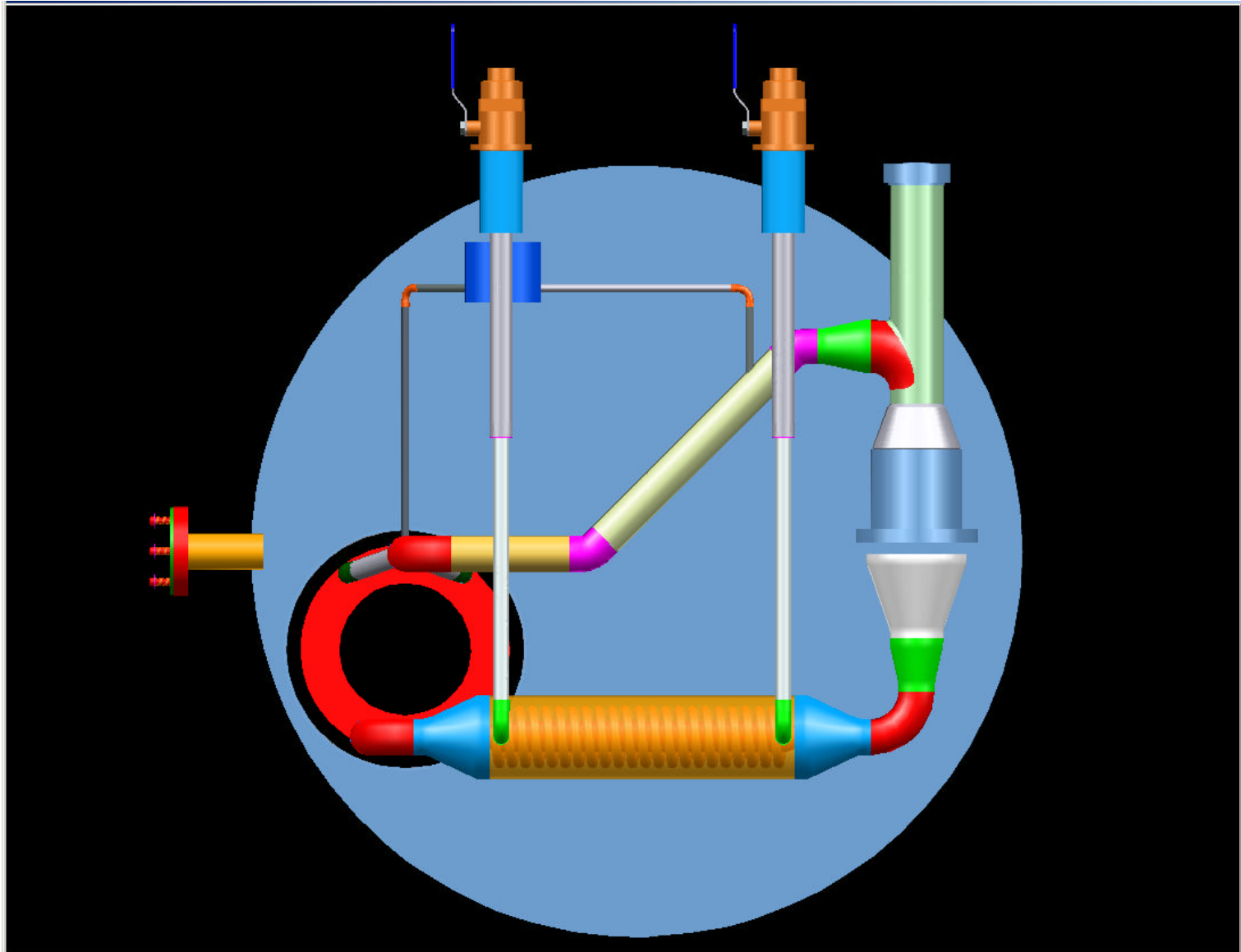
The LH2 supply is not shown.  
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connection located here



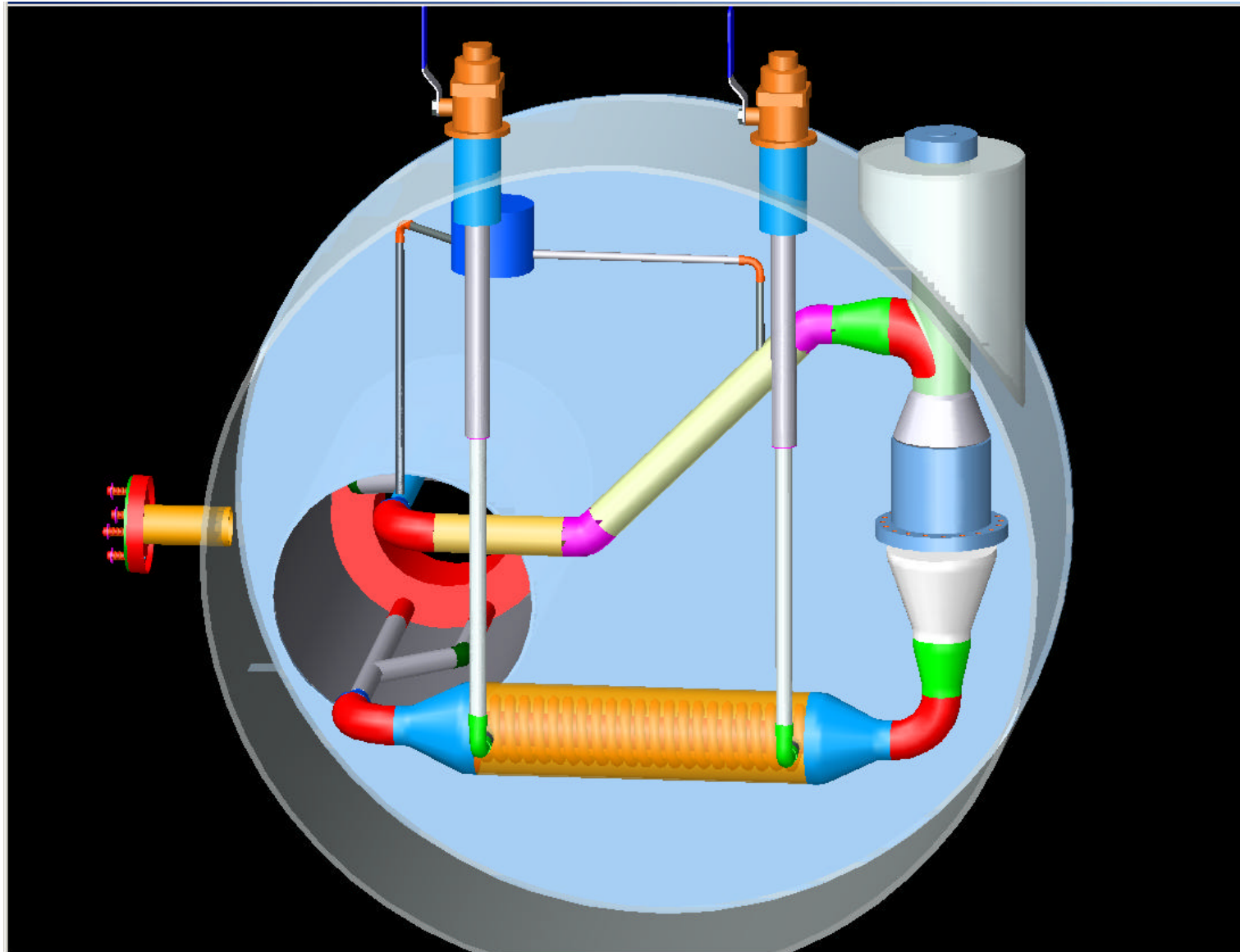
# LH2 Absorber Cryostat design



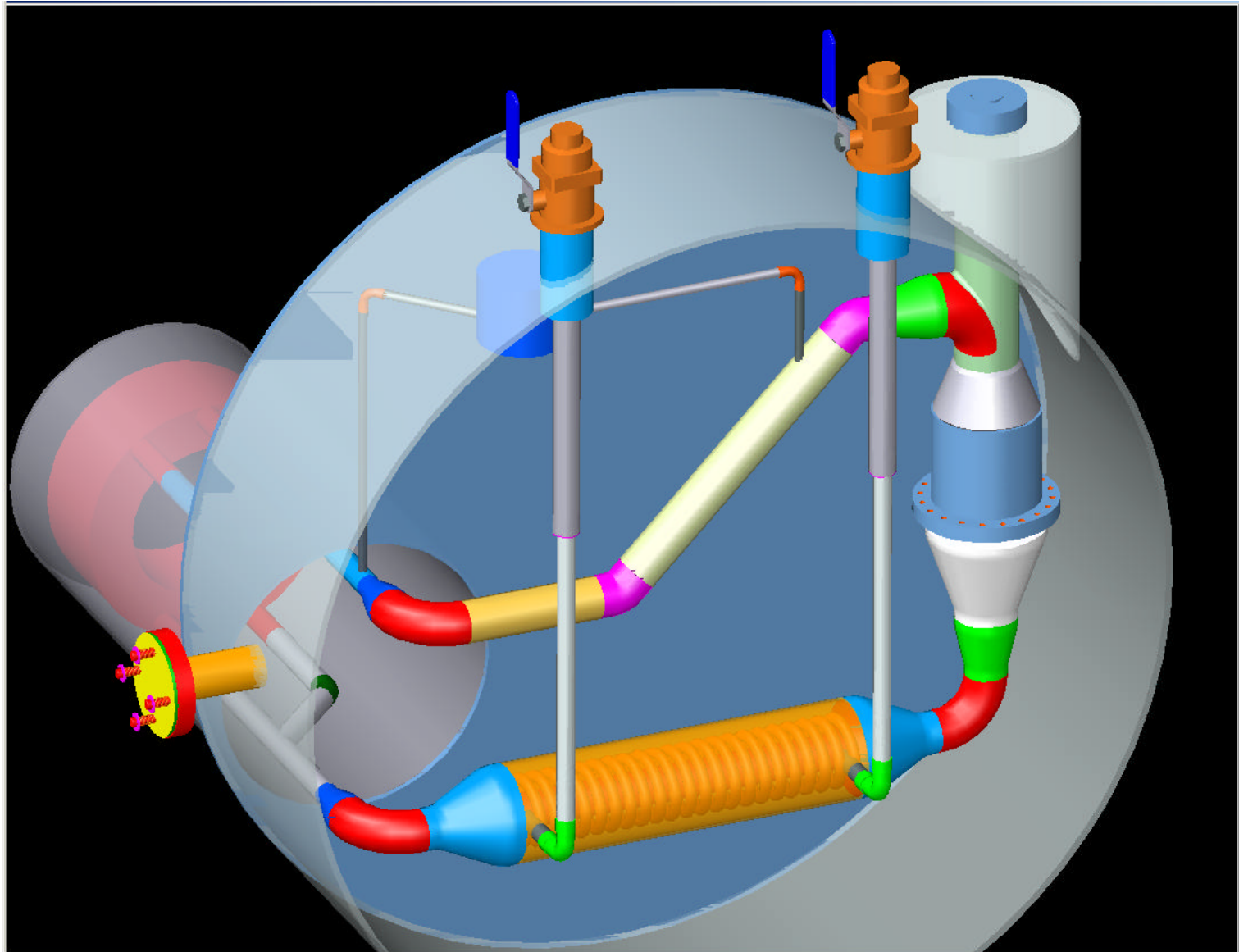
# LH2 Absorber Cryostat design



# LH2 Absorber Cryostat design

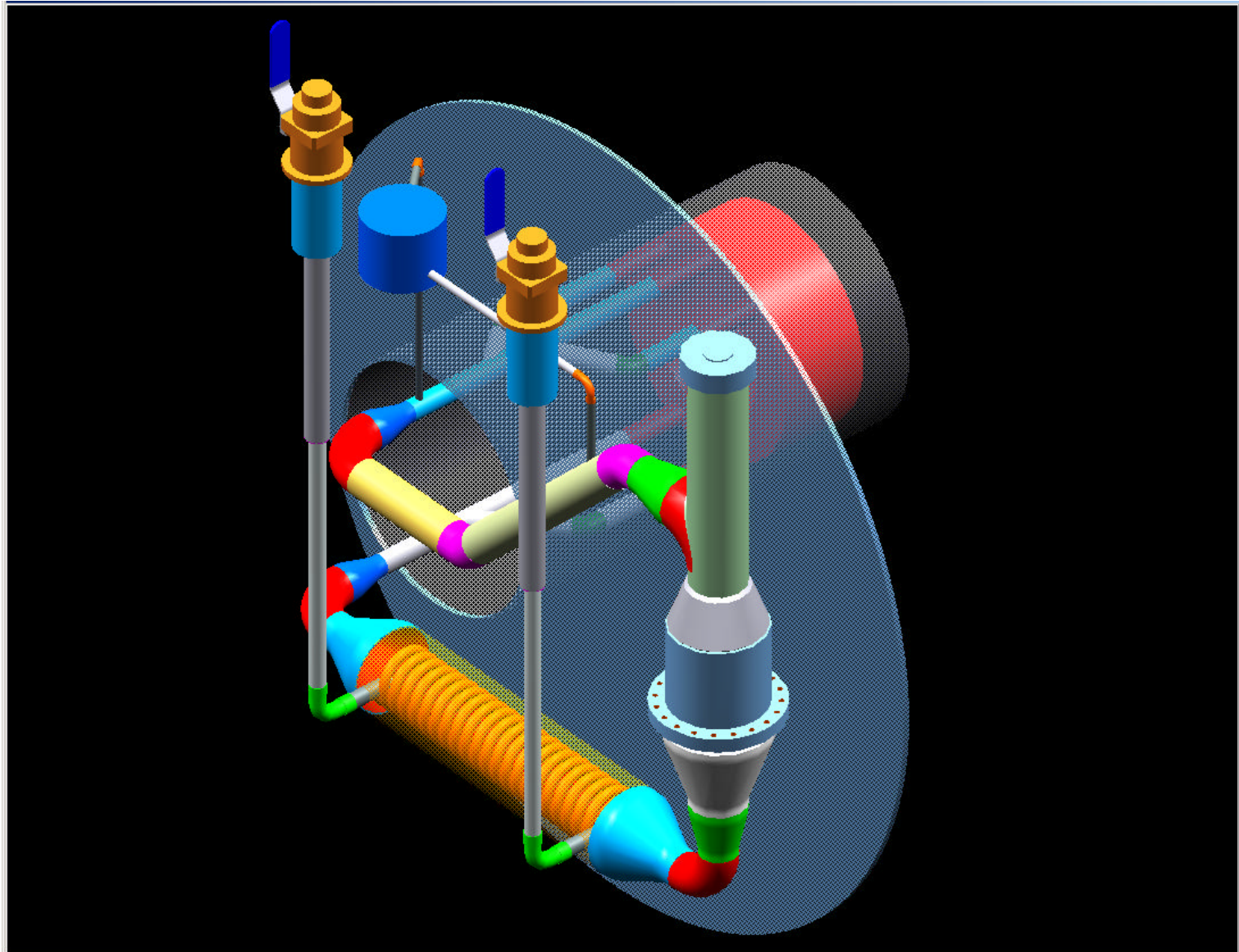




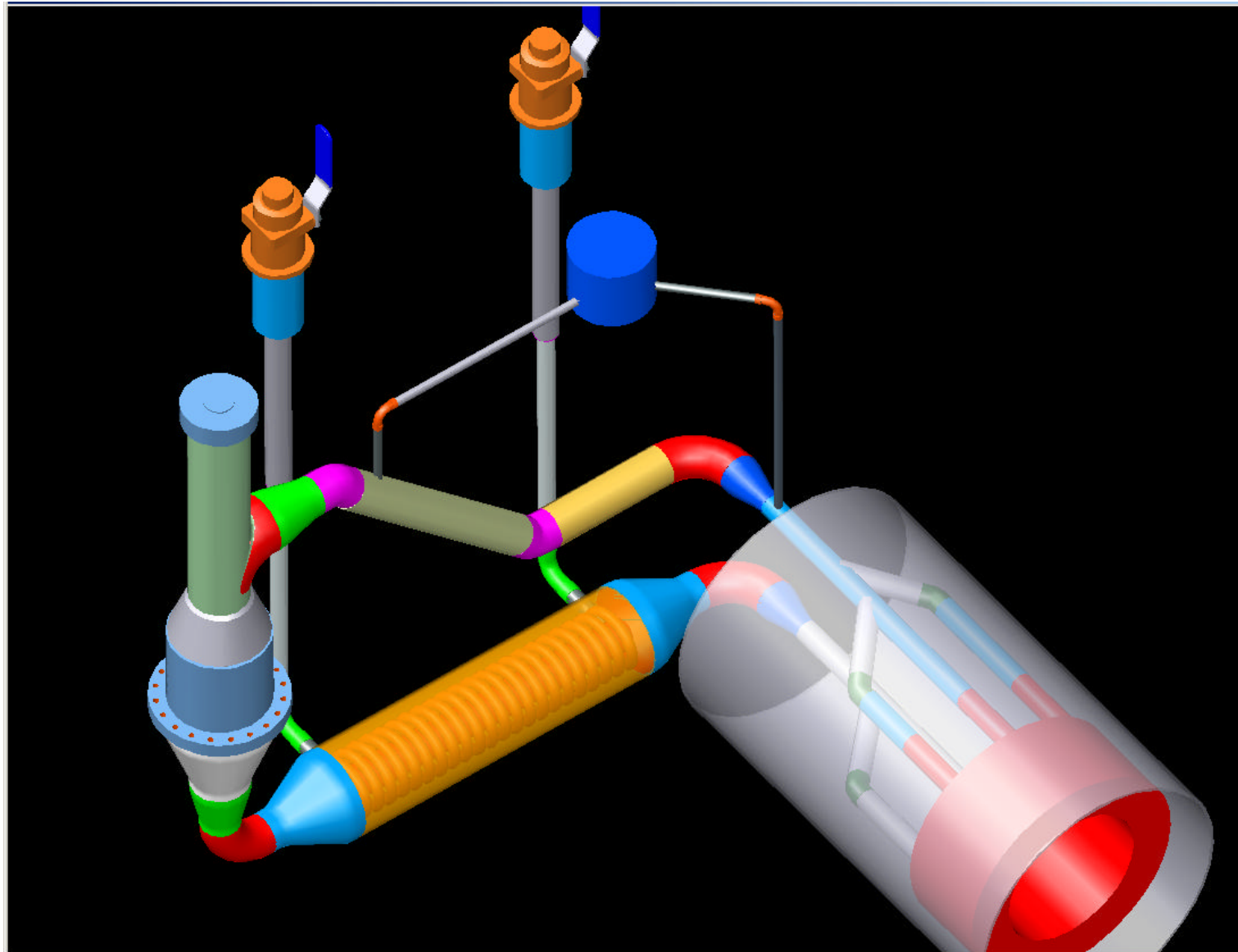




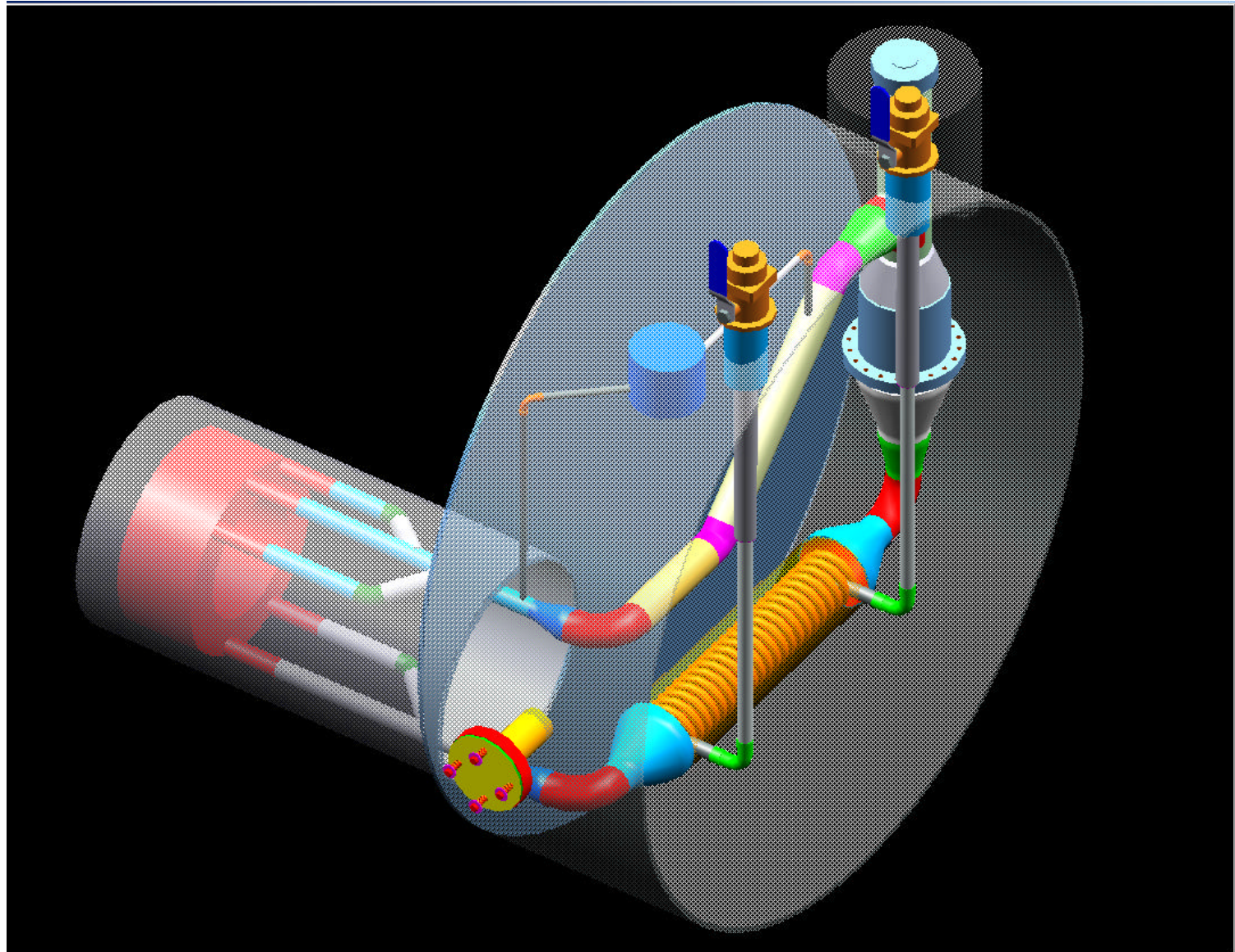
# LH2 Absorber Cryostat design



# LH2 Absorber Cryostat design

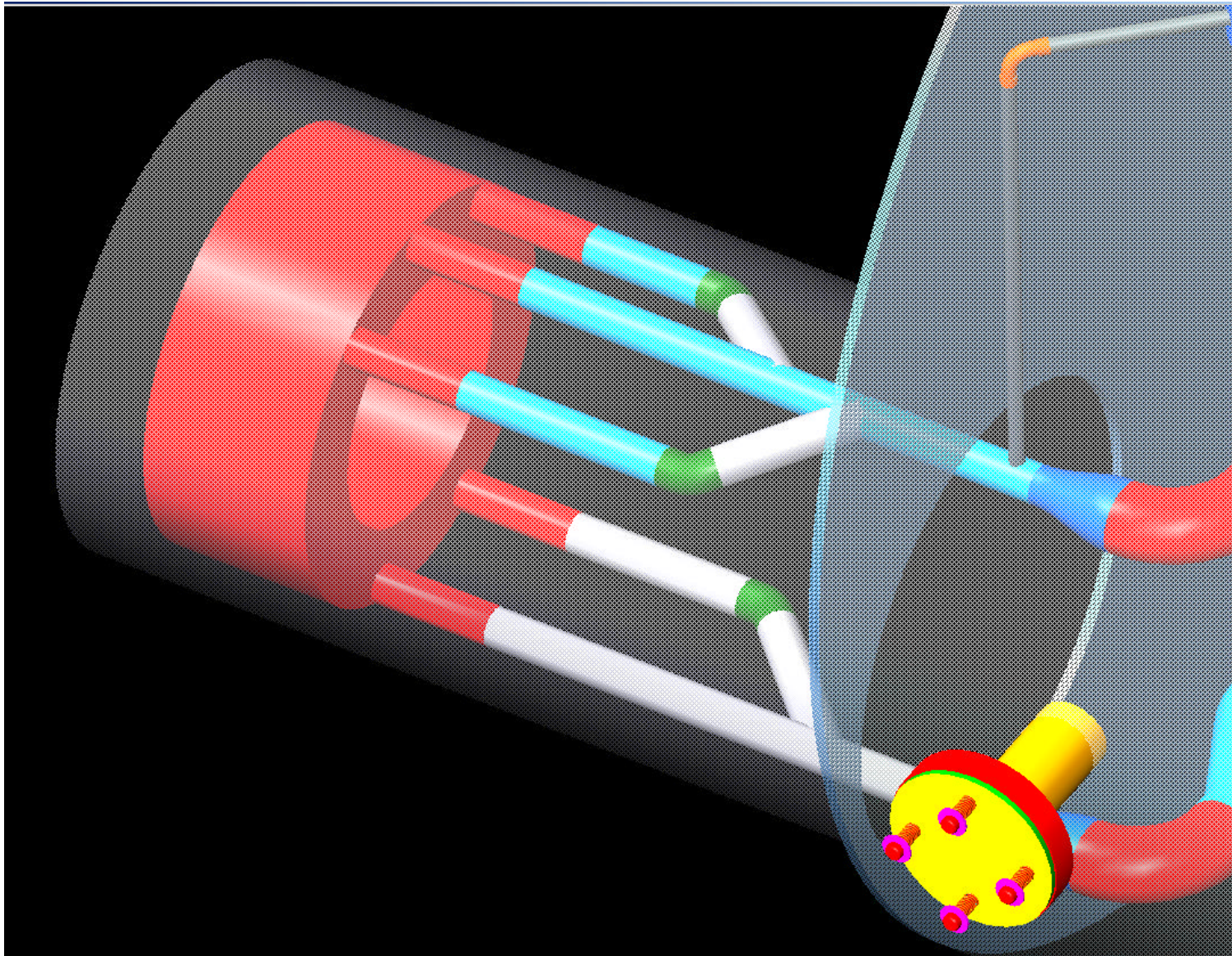


# LH2 Absorber Cryostat design





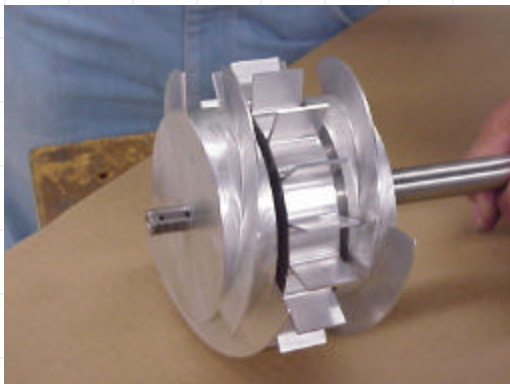
# LH2 Absorber Cryostat design



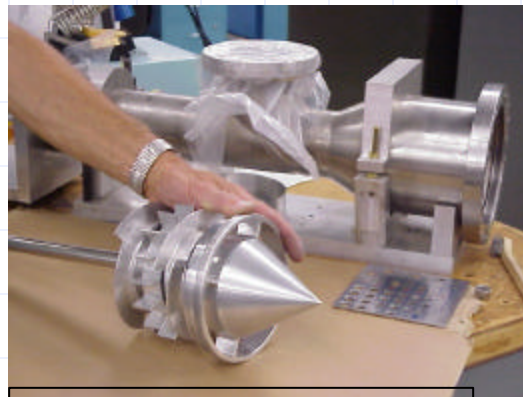


# Pump test - Overview

Water Pump test set-up at E4R



Impellers

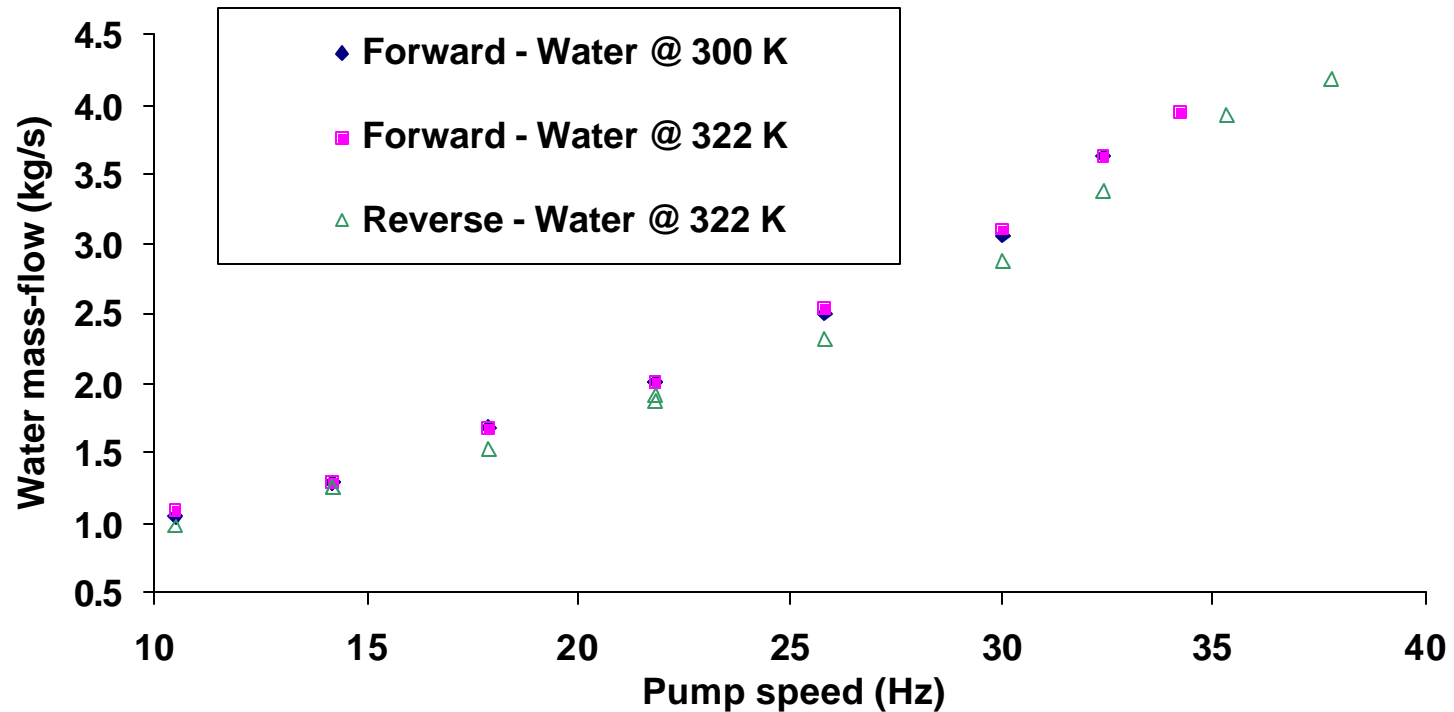


Pump and its housing



Heater

# Pump test – Preliminary results



## Preliminary conclusion

- ◆ Equivalent mass-flow in both forward and reverse mode
- ◆ No significant influence on pump efficient, for a DT of 22 K

# Conclusions

- PID: To be finalized after Reviews
  - ◆ Internal Review by end August
  - ◆ General Review to plan
- Design:
  - ◆ Final Designs after Reviews
  - ◆ Final detail drawings by end of November 2002 (or after reviews)
- Water pump test:
  - ◆ More test to validate the results
  - ◆ Correlation with LH2
  - ◆ Error analysis
  - ◆ Correlation with measurement of DT during experiment